Investigation of closed dynamic systems based on the Kapitsa phenomenon

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In our work we consider closed dynamical systems based on the Kapitsa phenomenon. As it turns out, not all systems of this kind can be clearly described by a static effective potential which may not predict accurately the region with interesting nonlinear solutions and unexpected balance points, hitting which depends on the ratio of time-averaged energies of the system. We hope to find more systems with such properties and propose their application in devices. In this work we have theoretically investigated the properties of the system, which we called "The double Kapitsa oscillator". We have described new, in relation to the ordinary Kapitsa pendulum, modes which exist in such an oscillator, and visualized them. The possibility of experimental confirmation of the results obtained by external excitation was also investigated. Furthermore, the behavior of our system in the limit of excitation with parameters opposite to the Kapitza pendulum was described in terms of parametric resonance.

The relevance of the work lies in the new scientific results, obtained during the processing of the material namely, the discovered new stable intermediate positions for the system, obtaining and simulation results that can help their experimental confirmation.

Keywords: Kapitsa phenomenon; Closed dynamical systems; Dynamic stabilization; Kapitsa pendulum; Parametric resonance; External excitation.